# Automated Supply, Equipment and Facilities Inventory System

**ALMERA D. LAGONERO**
Faculty_Jose Rizal Memorial State University – Siocon Campus
adlagonero@jrmsu.edu.ph

*Abstract* — The study aimed to develop an Automated Supply, Equipment and Facilities Inventory System for the supply office of the Jose Rizal Memorial State University System. This study utilized the developmental research method and there were thirty (30) respondents of the study to evaluate the functionality, reliability, usability, efficiency and maintainability of the system with a questionnaire patterned from the International Standardization Organization (ISO) 9126 quality standard model. Weighted mean was used to measure the effectiveness of the system and used the Likert's 5 – Point Scale to obtain participants preferences or degree of agreement with a statement or set of statements. The developed system offers to the supply office of the university as well as to the faculty and staff for fast and easy requisition of the supplies and materials. It allows automatic identification of the supplies, equipment and facilities that are still serviceable and non-serviceable, display of computation for depreciation value, consistency of the records from the supply office to the accounting office and assigning the custody of equipment through the use of the different tools such as barcode reader/scanner and radio frequency identification devices that serve important role in the operation. The system follows the perpetual inventory method where inventory accounting is updated continuously as transactions are made and allows real – time reporting of the inventory balance in stock.

It is recommended that Jose Rizal Memorial State University adopts the developed system called Automated Supply, Equipment and Facilities Inventory System to be able to provide and improve the processing of inventory of the supplies, equipment and facilities more quickly.

*Keywords — Inventory, Serviceable, Non - Serviceable, Perpetual Inventory, Depreciation*

## I. Introduction

Inventory system is basically a process wherein an organization keeps track and physically account its supplies and materials, tools and equipment. It is an effective way for monitoring and tracking different materials that are transferred in and out of a company's warehouse or establishment usually for accounting purposes. Effective inventory system ensures stocking the in demand and correct items in the correct quantities (Jones, 2012). Recording transactions in inventory can be done in two methods, the Perpetual System and Periodic Inventory System. Perpetual inventory is a method of recording inventory balances after each receipt and issue in order to ensure accuracy of perpetual inventory records, physical stocks should be checked and compared with recorded balance. While with a periodic inventory system a company knows how much inventory it has at the beginning of a period and at the end of a period. This system does not

track inventory on a daily basis, instead, it relies on periodic physical inventory counts to determine inventory levels (Brag, 2011).

While many organizations and even institutions at the present use technical system to improve the quality of their services, Jose Rizal Memorial State University has remains employing a manual method. Hence, the researcher was prompted to come up and build a system that will automate the transactions from the approve purchase order to updating the inventory database particularly to one which could keep track of inventory of items on a perpetual basis and identify equipment's and facilities that are still serviceable and unserviceable . One which ensures items are accounted for and that inflow and outflow status are updated on a continual basis. As well as informs when need to purchase more products or supplies, update number of inventory items are left or available for, automatically update database and generates report per day after each transaction is made.

Furthermore, the system is able to provide better assistance to the Supply Officer for the fast operation of monitoring the supplies and materials as well as the availability of the tools and equipment. Through the development and implementation of this automated supply, equipment and facilities inventory system, the researcher anticipate a quick processing of transaction in the Supply office as well as the consistency of reports both the supply and accounting office.

**Literature Review**

Over the years, the trend has been towards an integrated world economy. Firms have developed or are seeking to develop global strategies on how to avail products in different countries where they operate. Inventory management is the process of efficiently overseeing the constant flow or units into and out of an existing inventory. It is an attempt to balance inventory needs and requirements with the need to minimize costs resulting from obtaining and holding inventory (Lysons, 2006). Bernabe et al. (2007) on "Automated Inventory System Using Portable Data Acquisition Module for Bell Electronics Corporation" developed a system that composed of a barcode scanner to scan issued and received items, Z8F6423 Zilog microcontroller to store the information and power supply in order for it to operate effectively. The system used barcode scanner from the Codegate Technology which automatically activates the laser from the scanner in order to scan the barcode when it senses a barcode and automatically deactivates when the user is not scanning any barcodes. The main feature of the Zilog microcontroller was to communicate with the barcode scanner and relay the scanned information and store it in a temporary memory of the microcontroller. On the other hand, the study of "MSU Supply and Equipment Inventory System" in General Santos City, stressed that their prior operation in the supply office used manual procedures and when there are deliveries, they record it one by one in the ledger books and distribute items which is being requested by the end – user. The problems encountered in the present inventory were: difficulty in tracking list of supplies and equipment, too much time spent in consolidating numerous reports, manually records are not secured, extra effort was needed in listing new supplies and equipment, and time consumed with the way the organization operates

especially on the inventorying part such as listing of items and equipment and generating reports that needs to be done by the organization. Moreover, barcodes accelerate the flow of products and information throughout an enterprise. The most familiar example is the Electronic Point of Sale (EPOs) which is commonly used in supermarket, whereby sales are recorded by scanning a product's barcode at the checkout tills. The EPOs systems verifies, checks and charges transactions, provide instant sales reports, monitors and changes prices and sends intra – and inter stores messages and data. With the integration of Electronic Data Interchange (EDI) at the electronic point of sale, communication between suppliers and the supermarkets can be more effective. Barcodes represent a product identification that a computer will recognize when scanning the code. This will enable the retailer to know how much has come into the store, how much has been left the store as sales and by extension, how much should be left in the shelves. It alerts them on when to reorder and informs them on which items are selling (Lysons, 2006). The Automated Supply, Equipment and Facilities Inventory System for the Jose Rizal Memorial State University are closely related and similar to the literatures and studies stated and have relevance to the present undertaking. The study can be considered as a hybrid system since it combines to the different and unique features from the literatures and studies presented. Studies on "Automated Inventory System Using Portable Data Acquisition Module for Bell Electronics" of Bernabe et al., the "MSU Supply and Equipment Inventory System" of Borbon et al., and the "Electronic Point of Sale (EPOs) as cited by Lyson are similar to the developed system of the proponent. However, the unique feature of the present study that the other existing systems does not have is the capability of the system that connects to the accounting office from the supply office for the consistency of the records and automatically identify the list of supplies, equipment and facilities that are on the level of depreciation.

## II. Methodology

The study presents the system design, software development life cycle process, the necessary requirements of the hardware to strengthen the processing, and the output of the study which is the Automated Supply, Equipment and Facilities Inventory System. The first block of the schema is the input which contains the necessary requirements of the Automated Supply and Equipment Inventory System which comprise one (1) personal computer unit, one (1) handheld barcode reader/scanner, one (1) radio frequency identification (rfid), one (1) speaker, intranet, request and issuance slip, stocks information, employee's information, approved APP reference, article categorization, list of tangible items and estimated useful life.

The second block are the processes involved in the system which presents the software development life cycle process that includes Data Gathering where the researcher obtained all the important information that pertains to the development of the inventory system from the five campuses. It is a systematic gathering of data for a particular purpose from various sources that has been systematically observed, recorded and organized. Requirement Analysis is a process that includes analyzing, validating and specifying requirements where the necessary information for

the system are to be identified, determined of what criteria a system must meet that includes dataware, peopleware, hardware and software requirements. Designing where abstract representations of the system are to be prepared and the system design from the requirement specifications that includes the following: Entity Relationship Diagram, Architectural Design, Context Diagram, Data Flow Diagram Level and Flowcharts. After the design phase, the next is to perform coding of the appropriate program. Coding is a process which converts human readable commands or instructions into a machine-readable command which carries instructions to perform such particular function of a computer. The output of the coding phase is the source code for the software. Testing and Evaluation is where the program has to undergo testing and evaluation procedures as to the system requirements expected by the end users. It also includes detection of errors in the software and is tested against the requirements to make sure that the product is actually solving the needs addressed and gathered during the requirements phase. There are five measurement of the system, namely: functionality, reliability, usability, efficiency and maintainability.

The specific processes involved in this study include the requisitions of the items by the employees in which supply officer grants their request. After Supply officer grants the request of the employees, the system will automatically stores the item information and the custodian information to monitor the status of individual inventory of the items. Inventory level is monitored by the system based on the employee's requests and the arrival on delivery of the new purchased items. Database is always updated based on the different transactions performed so that it can easily be accessed, managed and updated. At the end of the day, month, and year, the supply officer can easily generate reports since the operation is done perpetually.

The third block of the schema is the output of the study which is the Automated Supply, Equipment and Facilities Inventory System of Jose Rizal Memorial State University. The specific output of the system includes the display of the real-time inventory; filter products; determine the inventory level; receive notification in inventory levels; imports and exports data; equipment custodian information; loss equipment information; damage equipment information; supply and equipment information; disposed waste materials and unserviceable equipment; reports of supplies and materials issued; reports on the physical count of property plant and equipment; inventory custodian slip information; stock cards for supplies and materials; property card for all property, plant and equipment; list of serviceable and non-serviceable items. Through this system software, the supply officer and all the employees are benefited with its efficiency and accuracy and become more productive on its respective work. The result of this study would greatly help increase the employee's productivity and improve its performance level.
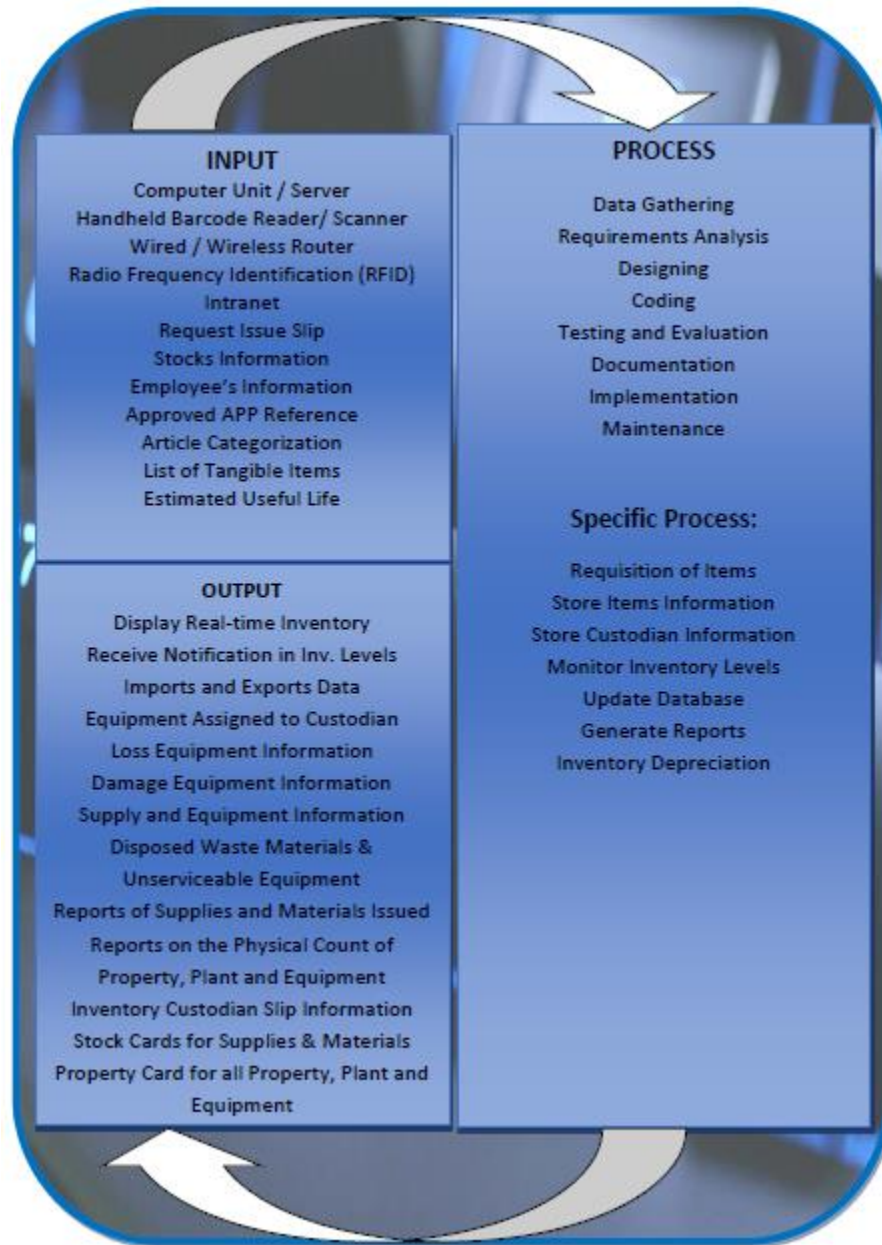
**INPUT**
Computer Unit / Server
Handheld Barcode Reader/ Scanner
Wired / Wireless Router
Radio Frequency Identification (RFID)
Intranet
Request Issue Slip
Stocks Information
Employee's Information
Approved APP Reference
Article Categorization
List of Tangible Items
Estimated Useful Life

**OUTPUT**
Display Real-time Inventory
Receive Notification in Inv. Levels
Imports and Exports Data
Equipment Assigned to Custodian
Loss Equipment Information
Damage Equipment Information
Supply and Equipment Information
Disposed Waste Materials &
Unserviceable Equipment
Reports of Supplies and Materials Issued
Reports on the Physical Count of
Property, Plant and Equipment
Inventory Custodian Slip Information
Stock Cards for Supplies & Materials
Property Card for all Property, Plant and
Equipment

**PROCESS**
Data Gathering
Requirements Analysis
Designing
Coding
Testing and Evaluation
Documentation
Implementation
Maintenance

**Specific Process:**
Requisition of Items
Store Items Information
Store Custodian Information
Monitor Inventory Levels
Update Database
Generate Reports
Inventory Depreciation

**Figure 1. The research design of the Study**

## III. Results and Discussion

There were thirty (30) total respondents of the study who were utilized to evaluate the developed system to strengthen the system's functionality, reliability, efficiency, usability, and maintainability of the system. They were classified into three (3) groups of evaluators from the different campuses namely: Dapitan, Dipolog, Katipunan, Tampilisan and Siocon. The first group comprises of the supply officer and storekeeper, second group comprises of the faculty and staff and on the third group comprises of the IT professionals.

Table 1 shows the rating of the software quality factor in terms of its functionality. The system obtained a mean of 4.39. It means that the system is very much functional since the system address all the requirements in automated inventory system, capable of data manipulation, security of the data, detection and handling of errors, compatible with other devices like barcode, radio frequency identification and printers, and adopt the huge amount of data storage and generates report consistently.

**Table 1 Software Quality Factor: FUNCTIONALITY**

| Functionality | 5 | 4 | 3 | AWV | Descriptive Rating |
|---|---|---|---|---|---|
| 1. The system addresses all the requirements in the automated inventory system. | 20 | 6 | 4 | 4.53 | Very Much Functional |
| 2. The system is capable of data manipulation, security of the data, detection and handling of errors. | 15 | 10 | 5 | 4.33 | Very Much Functional |
| 3. The system complies the end-user needs and its intended use. | 13 | 11 | 6 | 4.24 | Very Much Functional |
| 4. The system has compatibility with other system and integrates other devices like barcode and RFID. | 19 | 10 | 1 | 4.60 | Very Much Functional |
| 5. The system can adopt the huge amount of data storage and generates report consistently. | 13 | 12 | 5 | 4.26 | Very Much Functional |
| Mean | | | | 4.39 | Very Much Functional |

Table 2 shows the rating of the software quality factor in terms of reliability. The system obtained a mean of 4.44. It means the system is very much reliable since it gives accurate results to the user particularly to the supply office personnel, it is capable of resuming its task after any failures that may happen, it is capable of creating back-up system and free of error tolerance, is capable of data recovery and provides understandability of output and completeness of the system.

**Table 2 Software Quality Factor: RELIABILITY**

| Reliability | 5 | 4 | 3 | AWV | Descriptive Rating |
|---|---|---|---|---|---|
| 1. The system accurately gives results on the inventory level to the users specifically to the supply office personnel. | 20 | 8 | 2 | 4.59 | Very Much Reliable |
| 2. The system is capable of resuming its task after any failures that may happen. | 17 | 6 | 7 | 4.33 | Very Much Reliable |
| 3. The system is capable of creating back-up system and free of error tolerance. | 10 | 12 | 8 | 4.05 | Much Reliable |
| 4. The system is capable of data recovery | 10 | 11 | 9 | 4.02 | Much Reliable |
| 5. The system provides understandability of output and completeness of the system. | 15 | 10 | 5 | 4.33 | Very Much Reliable |
| | | | Mean | 4.26 | Very Much Reliable |

Table 3 shows the ratings of the software quality factor in terms of its efficiency. The system obtained an average mean of 4.05. The rating obtained in terms of efficiency was much efficient. This means that the system supports minimum hardware requirements, supports on number of user's at a time with many transactions, supports on business workflow process, increase production and quality outputs, performs speedy navigation and receives and retrieves data in a rapid manner.

**Table 3 Software Quality Factor: EFFICIENCY**

| Efficiency | 5 | 4 | 3 | AWV | Descriptive Rating |
|---|---|---|---|---|---|
| 1. The system supports minimum hardware requirements. | 15 | 10 | 5 | 4.33 | Very Much Efficient |
| 2. The system supports on number of user's at a time with many transactions. | 12 | 10 | 8 | 4.13 | Much Efficient |
| 3. The system supports on business workflow process | 10 | 5 | 10 | 3.33 | Efficient |
| 4. Increase system production and quality outputs. | 18 | 2 | 10 | 4.27 | Very Much Efficient |
| 5. Performs speedy navigation and receives and retrieved data in rapid manner | 13 | 10 | 7 | 4.20 | Much Efficient |
| | | | Mean | 4.05 | Much Efficient |

Table 4 indicates the rating of the software quality factor in terms of its usability. The system obtained an average mean of 4.65. The evaluation of the software projects in terms of usability was very much usable. This means that the user easily comprehend how to use of the system, the users learn automatically the use of the system and are satisfied with the outputs. The users use the system without much effort and training. Moreover, the interface of the system is pleasant to the eyes of the users. It also provides shortcuts for the users and buttons and commands are labeled appropriately.

**Table 4 Software Quality Factor: USABILITY**

| Usability | 5 | 4 | 3 | AWV | Descriptive Rating |
|---|---|---|---|---|---|
| 1. The users easily comprehend how to use the system. | 22 | 8 | | 4.74 | Very Much Usable |
| 2. The users can learn automatically in using the system and satisfied with the outputs. | 20 | 9 | 1 | 4.63 | Very Much Usable |
| 3. The users can use the system without much effort and more training. | 23 | 5 | 2 | 4.70 | Very Much Usable |
| 4. The interface of the system is pleasant to the eyes of the users. | 22 | 6 | 2 | 4.67 | Very Much Usable |
| 5. The system provides shortcuts for the users and buttons and commands are labeled appropriately. | 19 | 7 | 4 | 4.50 | Very Much Usable |
| | | | Mean | 4.65 | Very Much Usable |

Table 5 indicates the ratings of the software quality factor in terms of its maintainability. The system obtained an average mean of 4.24. This means that system defects are easily diagnoses can be easily modified if there are changes to be made, can easily accommodate for any modification or configuration of system operation made by the developer, compliance of concurrent system requirements and system has its advance features for recent technology.

**Table 5 Software Quality Factor: MAINTAINABILITY**

| Maintainability | 5 | 4 | 3 | AWV | Descriptive Rating |
|---|---|---|---|---|---|
| 1. The system defects are easily diagnosed. | 17 | 10 | 3 | 4.46 | Very Much Maintainable |
| 2. The system can be easily modified if there are changes to be made. | 15 | 13 | 2 | 4.43 | Very Much Maintainable |
| 3. The system can easily be accessible for any modification or configuration of system operation made by the developer. | 20 | 9 | 1 | 4.63 | Very Much Maintainable |
| 4. Compliance of concurrent system requirements. | 20 | 8 | 2 | 4.60 | Very Much Maintainable |
| 5. The system has its advance features for recent technology | 19 | 11 | | 4.00 | Much Maintainable |
| | | | Mean | 4.24 | Very Much Maintainable |

Table 6 presents the interpretation of results measuring the extent of effectiveness of the software project in terms of functionality, reliability, efficiency, usability and maintainability as evaluated by a selected faculty, staff and supply office personnel of Jose Rizal Memorial State University. Based on the data, the developed system meets the quality requirements and was found acceptable and effective.

**Table 6 Summary of the Project Evaluation**

| Software Quality Factors | Mean | Descriptive Rating |
|---|---|---|
| Functionality | 4.47 | The software project is very much functional |
| Reliability | 4.26 | The software project is very much reliable in terms of accuracy of performance |
| Efficiency | 4.05 | The software project is much efficient |
| Usability | 4.65 | The software project is very much usable |
| Maintainability | 4.24 | The software project is very much maintainable |
| **OVERALL** | **4.33** | **The system software is acceptable and effective** |

Jose Rizal Memorial State University System relies on the manual method of transactions in the inventory and withdrawal of items. Microsoft Excel application was adopted in the inventory of supply and equipment. Withdrawal of items did not coincide on the record keeping on the status of the stock room and a possibility of redundancy in entering the supplies and equipment that takes much time in making inventory. Inventory in each campuses resulted to some inaccuracies and inconsistencies of the records both in the Accounting and Supply Office. Reports on depreciation of items and list of serviceable and unserviceable of items were not properly done. There was no report available for depreciation, thus resulting to a major problem of the university in terms of monitoring the status of the equipment and facilities. The newly developed system provides the inventory environment that gives ease to the supply office to do the task effectively. A machine readable code in the form of numbers and a pattern of parallel lines of varying widths printed on and identifying a product that is called a Barcode scanner is being used to track and store information about the supplies and equipment from individual to large stocks of items. When a faculty or staff withdraws a particular supplies or equipment, it will automatically record to the stock card for supplies and property card for equipment. So before the end of working hours, the supply officer can generate and print the reports. Radio frequency identification (RFID) is used to check and to track the equipment whosoever the custodian. The list of depreciated items are automatically identified and resulted to the items which are serviceable and non-serviceable. The current and similar processes for Supply, Equipment and Facilities Inventory System were integrated to come up with the Automated Supply, Equipment and Facilities Inventory System.

## IV. Conclusion

The new developed system facilitates the operations in the Supply Office through the use of the different tools to lessen the processing time in doing transactions, supply officer conduct inventory with the assistance of the RFID, by reading the RFID Tags attached to the items assigned by a particular employee. Employees can easily do their request of the different supplies and materials using the terminal or computer in each department which is directly connected by the LAN to the supply office. Their request will be granted by the supply officer and let the employee conform on the granted quantity before the requisition will be printed. Once conformed, supply

officer or storekeeper then pull out the requested items and deliver directly to the employee concerned while at the same time signing of the request ad issue slip as an evidence of their request which will then be used as an attachment to the monthly reports. With the different features fused in the system, a high degree of functionality, reliability, usability, efficiency and maintainability of the system are achieved making it highly acceptable for users.

## REFERENCES

[1] Bernabe, et.al (2007). Automated Inventory System Using Portable Data Acquisition Module for Bell Electronics Corporation. DLSU Engineering e-Journal, Vol 1 No. 1, pp.138 – 150

[2] Borbon, et. al. (2012). MSU Supply and Equipment Inventory System. Bragg, Steven (2011). Inventory Best Practices (2nd edition). John Wiley and Sons. Jones, Rich, et.al (2012). Cornerstone of Financial and Managerial Accounting.

[3] Lysons, et.al (2006). Purchasing and Supply Management (7th edition). McGraw-Hill Publishing Company.